Fans

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What is a fan ?

In the Wikipedia: It is a device used to produce an airflow for the purpose of creature comfort, ventilation, exhaust, or any other gaseous transport.

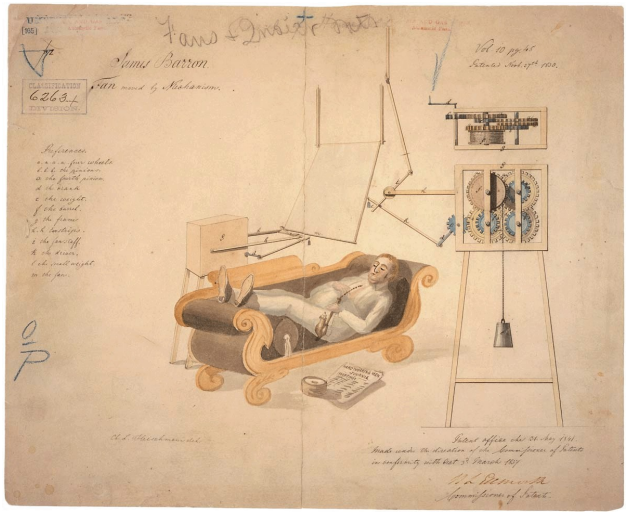
In the Oxford Dictionary: An apparatus with rotating blades that creates a current of air for cooling or ventilation.

In the Longman Dictionary: A machine with turning blades that is used to cool the air in a room by moving it around.

In the Wiktionary: An electrical device for moving air, used for cooling people, machinery, etc.

What is the history of fans ?

The first recorded mechanical fan was the punkah fan used in the Middle East in the 1500s. It had a canvas covered frame that was suspended from the ceiling. Servants, pulled a rope connected to the frame to move the fan back and forth.



The Industrial Revolution the late 1800s introduced belt-driven fans powered by factory waterwheels. Attaching wooden or metal blades to shafts overhead that were

used to drive the machinery, the first industrial fans were developed. One of the first workable mechanical fans was built by A.A. Sablukov in 1832. He called his invention, a kind of a centrifugal fan, an Air Pump. Centrifugal fans were successfully tested inside coal mines and factories in 1832-1834. When Thomas Edison and Nikola Tesla introduced electrical power in the late 1800s and early 1900s for the public, the personal electrical fan was introduced. Between 1882 and 1886, Dr. Schuyler Skaats Wheeler developed the two-bladed desk fan, a type of personal electric fan. It was commercially marketed by the American firm Crocker & Curtis electric motor company. In 1882, Philip H. Diehl introduced the electric ceiling fan. Diehl is considered the father of the modern electric fan. In the late 1800s, electric fans were used only in commercial establishments or in well-to-do households. Heat-convection fans fueled by alcohol, oil, or kerosene were common around the turn of the 20th century.

The first American made fans, made from around the late 1890s to the early 1920s were very stylish. They had brass blades, a lot of them also had brass cages, and though they were built very well internally, they were far from finger safe, as a lot of them had cage openings so big that one could put an entire hand or arm right through it. Many children had hands and fingers severely injured by those fans.

In the 1920s, industrial advances allowed steel to be mass-produced in different shapes, bringing fan prices down and allowing more homeowners to afford them. In the 1930s, the first art deco fan was designed. Before this fan, called the Silver Swan, most household fans were fairly plain. In the 1950s, fans were manufactured in colors that were bright and eye catching.

What Are The Types Of Fans ?

The Ceiling Fan :

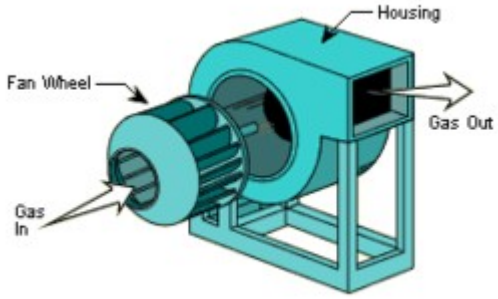
A ceiling fan is a device suspended from the ceiling of a room, which employs hub-mounted rotating paddles to circulate air in order to produce a cooling or destratification effect.

The Components:

- An electric motor
- Two to six paddles usually made of wood, MDF, metal, or plastic; which mount under, on top of, or on the side of the motor.
- Metal arms, called blade irons (alternately blade brackets, blade arms, blade holders, or flanges), which connect the blades to the motor.
- A mechanism for mounting the fan to the ceiling
  - Some fans mount using a "ball-and-socket" system. With this system, there is a metal or plastic hemisphere mounted on the end of the downrod; this hemisphere rests in a ceiling-mounted metal bracket and allows the fan to move freely (which is very useful on vaulted ceilings).
  - Some fans mount using a J-hook system. In this system, a metal hook (which comes in a variety of configurations) secures to a ceiling-mounted metal bolt (again, available in a variety of configurations). Usually, there is a rubber bushing inserted between the hook and the bolt as a noise-reduction agent.
  - Some fans can be mounted using a Low-Ceiling Adapter, a special kit which must be purchased from the fan's manufacturer. This eliminates the need for a downrod, and is therefore useful in rooms with low ceiling clearance.

The Centrifugal Fan :

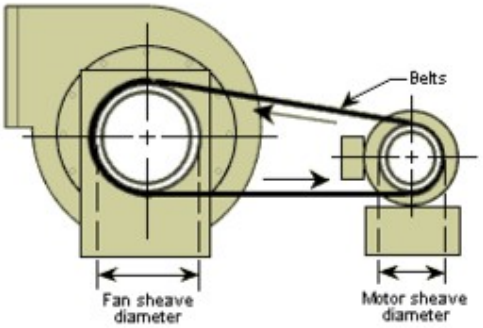
is a mechanical device for moving air or other gases. It has a fan wheel composed of a number of fan blades mounted around a hub. As shown in Figure 1, the hub turns on a driveshaft that passes through the fan housing. The gas enters from the side of the fan wheel, turns 90 degrees and accelerates due to centrifugal force as it flows over the fan blades and exits the fan housing. *Centrifugal fans can generate pessure rises in the gas stream.* Accordingly, they are well-suited for industrial processes and air pollution control systems.



The Components:

- Direct drive: The fan wheel can be linked directly to the shaft of an electric motor. This means that the fan wheel speed is identical to the motor's rotational speed. With this type of fan drive mechanism, the fan speed cannot be varied unless the motor speed is adjustable.

- Belt drive: Belt driven fans use multiple belts that rotate in a set of sheaves mounted on the motor shaft and the fan wheel shaft.

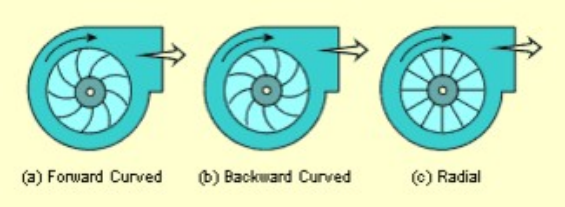


- The belts transmit the mechanical energy from the motor to the fan.

- Variable drive: Variable drive fans use hydraulic or magnetic couplings (between the fan wheel shaft and the motor shaft) that allow control of the fan wheel

speed independent of the motor speed. The fan speed controls are often integrated into automated systems to maintain the desired fan wheel speed.

- An alternate method of varying the fan speed is by use of an electronic variable-speed drive which controls the speed of the motor driving the fan. This offers better overall energy efficiency at reduced speeds than mechanical couplings.
- Fan dampers: Fan dampers are used to control gas flow into and out of the centrifugal fan. The may be installed on the inlet side or on the outlet side of the fan, or both. Dampers on the outlet side impose a flow resistance that is used to control gas flow. Dampers on the inlet side are designed to control gas flow and to change how the gas enters the fan wheel.
- Inlet dampers reduce fan energy usage due to their ability to affect the airflow pattern into the fan.
- Fan blades: The fan wheel consists of a hub on which a number of fan blades are attached. The fan blades on the hub can be arranged in three different ways: forward-curved, backward-curved or radial.
- Forward-curved blades: Forward-curved blades, as in Figure 3(a), use blades that curve in the direction of the fan wheel's rotation. These are especially sensitive to particulates. Forward-curved blades are for high flow, low pressure applications.
- Backward-curved blades: Backward-curved blades, as in Figure 3(b), use blades that curve against the direction of the fan wheel's rotation. These types of fan wheels are used in fans designed to handle gas streams with relatively low particulate loadings because they are prone to solids build-up. Backward-curved fans are more energy efficient than radial blade fans. Backward curved blades are used for high pressure, low flow applications.
- Straight radial blades: Radial fan blades, extend straight out from the hub. A radial



blade fan wheel is often used on particulate-laden gas streams because it is the least sensitive to solids build-up on the blades.

The Computer Fan :

A computer fan can be any fan inside a computer case used for cooling purposes, and may refer to fans that draw cooler air into the case from the outside, expel warm air from inside, or move air across a heatsink to cool a particular component. The use of fans and/or other hardware to cool a computer is sometimes referred to as active cooling.

What About the Fan Motor ?

A stand alone fan is typically powered with an electic motor. An electric motor's poor low speed torque and powerful high speed torque are a natural match for a fan's load. Fans are often attached directly to the motor's output, with no need for gears or belts. The electric motor is either hidden in the fan's center hub or extends behind it. For big industrial fans, 3-phase asynchronous motors are commonly used, placed near the fan and driving it through a belt and pulleys. Smaller fans are often powered by shaded pole AC motor, or brushed or brushless DC motors. AC-powered fans usually use mains voltage, while DC-powered fans use low voltage, typically 24 V, 12 V or 5 V. Cooling fans for computer equipment exclusively use brushless DC motors, which produce much less electromagnetic interference. In machines which already have a motor, the fan is often connected to this rather than being powered independently. This is commonly seen in cars, boats, large cooling systems and winnowing machines, where the fan is connected either directly to the driveshaft or through a belt and pulleys. Another common configuration is a dual-shaft motor, where one end of the shaft drives a mechansim, while the other has a fan mounted on it to cool the motor itself.

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